The Mining Journal.

No. 384.] SUPPLEMENT. [Dec. 31.

MUSEUM OF ECONOMIC GEOLOGY OF INDIA.

The Museum of Economic Geology of India, to which attention is directed in our advertising columns, has been established by Government, under orders from the court of directors of the East India Company, in conjunction with the Asiatic Society. Its objects, it will be observed, are, in common with those of similar establishments, of which we possess one in this city, under the superintendence of Sir H. de la Beche, the acquirement of geological, mineralogical, and statistical information, for the benefit of the community at large, and displaying a liberality on the part of Government which we are induced to hope is an earnest for the future. The mineral resources of India, which are far from having been developed, will thus become known, and rendered useful to the geologist, the metallurgist, and the miner, while the collection of rocks, and the various descriptions of stone, will afford to the engineer and architect advantages which, without an institution of this nature, it would be futile to expect. To the agriculturist the importance will be considerable, as, by a collection of the various kinds of soils remarkable for their good or bad qualities, with the subsoil and subjacent rocks, he will be enabled to avail himself of the knowledge acquired by means of the labours of the institution.

To effect those desired ends, it requires, in the first place, that aid should be rendered by all who have it in their power, and that facilities should be afforded by the East India Company for the transmission of specimens and communications calculated to promote the laudable objects of Government. Without such assistance it is only natural to expect that the progress must be very limited, but, in proportion as it is afforded, hopes may be confidently entertained, that the resources of India may become developed, and full justice done to her mines and quarries, while the soil may be expected to be enriched by the discoveries and application of science to practical agriculture. The desiderata for the museum are fully entered upon in the address to which we have referred, while we may here repeat, that specimens, however insignificant in the opinion of those who may possess them, from being familiar, and of common occurrence, will become highly valuable to the museum, placed at so great a distance from us, if only as, to use the words of the address, such specimens, "if not wanted for the institution, may serve to procure that which is;" and, therefore, indirectly tend to the attainment of the object in view—that of enriching the collection. It is unnecessary to dwell on the advantages which must arise from the establishment in India of a museum of economic geology, or to point out the desired acquisition of knowledge, whether stored in books, or gathered from the laborious researches of the geologist and mineralogist, while specimens, drawings of machinery, sections and plans of mines, &c., will be truly useful in the advancement of its objects. We shall at all times be ready to lend our humble aid in the promotion of institutions of this nature, and shall gladly give insertion in our columns to any communication connected therewith, which may tend to the promulgation of science, trusting that the information we may collect from India will hereafter form interesting matter for the perusal of our readers, and which we may expect will be more valuable and comprehensive in the ratio of the assistance afforded in enabling it effectually to carry out the views of Government, and all those who take an interest in science.

COAL-FIELDS OF GREAT BRITAIN.—No. VI.*

MID-LOTHIAN COAL FIELD—UPPER SERIES.

In the account we have furnished of the coal-fields of the valley of the Clyde, we have mentioned many facts regarding its strata, equally applicable to almost all coal-fields whatever. Some of these relate to the general structure of the strata, which usually consist of alternating layers of sandstone, massive and laminated; micaceous, sandy, and clay shales, of various colours, but chiefly grey, black, and bluish grey; fire clay, with imbedded nodules of clay ironstone, or layers of ferruginous sandstone; ironstone in bands, fewer or more in number, and when intermixed with coaly matter, of the character of what is called black-band. Ironstone, however, occurs most frequently in clay-shale strata, in thin bands or nodular layers. The colour is generally slate grey, but sometimes red. Black-band ironstone is black or fawn coloured, with streaks or riband like stripes of coal, or coaly matter, alternating with thin layers of the ironstone. The coal occurs most frequently in rhomboids; when possessed of a splintery fracture, it is called splint coal; when compact and in cubic masses, it is called cannel coal. Anthracite, or blind coal, is that variety which does not emit flame. The limestones are commonly of various shades of grey; and, when of marine origin, almost always appear as if, in a great measure, composed of minute encrinal or coralline remains, sometimes intermixed with shells. The beds of these minerals are of no determinate thickness or order, as to the mode of superposition, except, that coal may generally be said to overlie a bed of fire-clay, containing exclusively the remains of the *stigmaria ficoides*, and that the roofs of coal almost always, or frequently, consist of clay-shale or faikes—a name generally applied to sandy carboniferous shales. Such is a brief outline of the lithological nature of a coal-field in general—each varies from another, and even from itself in different places, in the mode of superposition, vertical and horizontal extent; in the number and position of the coal and limestone, and other beds, &c. Almost all coal-fields are traversed by what are called faults, slips, hitches, or dislocations, by which the strata on one side is sunk to a greater depth, or raised to a higher level than the same beds on the other; or, in other words, a fault is a crack, by which contiguous portions of a coal-field are thrown out of their original continuity. The term dyke is often erroneously given to such dislocations; hitch, step, or slip, is commonly applied to the smaller faults.

Coal-fields are often traversed by dykes, properly so called. These consist of trap rock, or other foreign matter, injected into a rent or fissure in the strata, and occur in the form of walls or dykes. Sometimes they occasion a dislocation of the strata; but more frequently the same beds are found on either side of a dyke in the same place. Coal-fields are also traversed by what are called backs and cutters; these cross each other, in general, at a determinate angle, and divide the mass of a bed into large rhomboids. These are of great use in the extraction of coal and other minerals, such as limestone, ironstone, or sandstone. The organic remains of one coal-field have generally a strict analogy to those of another. The plants consist of the stigmaria, lepidodendron, sigillaria, calamites, ferns, &c. The fishes are almost always covered with enamelled rhomboidal scales, and the shells are both referable to fresh and marine genera. In all these matters the Mid Lothian coal-field may be regarded as agreeing with that of the west of Scotland. We can merely notice the many important beds of coal and limestone which occur in it—to enter into detail as to the number, nature, and effects of the numerous faults by which it is intersected, is not our intention. Those wishing for this and such other information as our limits hinder us from giving, must have recourse to the excellent memoir of Mr. David Milne on the subject, to whom the geological world is much indebted for the very lucid description which he has given of this field. The coal formation of the Mid-Lothians, like that of the west of Scotland, is divisible into the upper, middle, and lower series. The upper contains no limestone, and such shells as do occur are referable to freshwater genera. This series overlies a calcareous bed called the Caldcoats limestone, occurring on the shore at Joppa, at Magdalen Pans, and Gilmerton. It is about three feet thick, and contains marine remains. The coals which occur in the upper series, that is, the strata overlying the Caldcoats limestone, are twenty-five in number. The uppermost of which are wrought for the supply of the Edinburgh market, at Craighall, and Sherrifhall, in the neighbourhood of Dalkeith. The following is a section taken at New Craighall to the diamond coal:—

	Ft.	in.
Blais or shales	6	0
Sandstone	4	0
Blais	16	0
First coal	3	0
Clay shale	3	0
Sandstone	4	0
Blais	12	0
Sandstone	3	0
Blais	6	0
One and a half coal	1	6
Sandstone	3	0
Ditto red	3	0
Blais	3	0
Ditto, mixed with sandstone	5	0
Red and grey sandstone	6	0
Red and yellow ditto	24	0
Red Blais	12	0
Sandstone	40	0
Blais	3	0
Sandstone	12	0
Blais and yellow	12	0
Red and white sandstone in different beds	138	0
Blais	4	0
Splint coal	5	0
Sandstone and blais	24	0
Blais	12	0
Sandstone	0	6½
Sandstone	18	0
Rough coal	4	0
Blais	43	0
Sandstone	5	0
Sandstone and blais	9	0
Beefie coal	3	0
Sandstone	30	0
Grey bands of sandstone	16	0
Red blais	30	0
Red and white sandstone	22	0
Blais	22	0
Diamond coal	6	0
	750	6½

We have evidence in this portion of the coal-field of Mid-Lothian, that red-coloured sandstones and shales are frequently associated with valuable coal; and though the occurrence of similar sandstones and shales in other localities may be accompanied by coal; yet, as mistakes in cases of this kind may be likely to arise, proprietors ought to have such deposits well examined by a practical geologist, in order to determine whether the strata truly belongs to the carboniferous series or not, before incurring the expense of searching for coal by boring or otherwise. A mining engineer, without a competent knowledge of the principles of geology will be of little or no use in such investigations; and a geologist, on the other hand, without practical experience of the nature of coal-fields, would be still worse.

1. Coal.—This coal occurs at Joppa and New Craighall, and is from four to five feet thick.

2. The Splint Coal occurs at Joppa at a distance of eight fathoms, and is from six to seven feet thick; at New Craighall, Monkton Engine and Miller-hill, Sherrifhall, and Edmondstone, the distance from the jet coal is from twenty-nine to thirty fathoms, and thickness from four to six feet.

3. The Rough Coal lies from seven to seven and a half fathoms below the splint. It is wrought at New Craighall, from four to five feet thick. At Millerhill it is divi[illegible] a stone of four inches, and measures four feet inclusive. At Sherrifha[illegible] is six feet in one pit, and only three and a half in another (No. 15). At Edmonstone it measures 4 ft. 2 in.

4. The Beefie Coal.—This coal occurs from six to eight fathoms, generally eight below the rough coal. At Sherrifhall it is divided by a bed of rock, said to be nineteen feet thick. At Edmonstone the parting consists of only eight inches of clay. The entire thickness of the seam is from three to five feet. The localities where it is wrought at are New Craighall, Millerhill, Sherrifhall, Edmonstone, Pinkie-house, and Castlesteads.

5. The Diamond Coal lies from eleven to fourteen—commonly eleven—fathoms below the *Beefie* seam. At Monkton engine the thickness is only two and a half feet; but at Sherrif hall it is 4 ft. 10 in.; at Castlesteads, three feet; Pinkie-house, three and a half feet; and at Millerhill, four and a half, including fourteen inches of a stone.

6. The Jewel Coal.—This seam occurs from six to seven fathoms below the diamond coal. It is much esteemed as a good household coal in the Edinburgh market. At New Craighall it measures from four to five and a half feet; but at Monkton, Sherrifhall, Edmonstone, Pinkie-house, and Castlesteads, the thickness is from four to four and a half feet.

7. The Golden Coal lies seven fathoms below the Jewel seam. It occurs two and a half feet thick, at Millerhill and New Craighall, but is only eighteen inches at Sherrifhall.

8. The next coal is known by various names—such as the Dalkeith upper coal, the Cowpits splint coal, the diamond, and Hunter's coal. At the New Elden pit it is fifteen fathoms below the golden coal, where it measures 3 ft. 9 in. At Niddry it is 5 ft. 10 in.; and at other places it is about three feet. It is the uppermost coal at Rosewell village and Cowpits.

9. Coal.—This seam occurs from ten to eleven fathoms below the former coal. At the New Eldin pit it measures 3 ft. 4 in.; at Cowpits, five feet; and at Castlesteads, four and a half feet.

10. Coal.—This coal lies three fathoms one foot below the ninth coal, at Castlesteads, where it is three feet thick. It does not appear to be known anywhere else.

11. Coal.—This seam also occurs at Castlesteads, and is three fathoms two feet below the former coal. At Eldin, where it is an upper coal, it is two and a half feet; and at Castlesteads it measures about the same in thickness.

12. Coal.—This is a six-inch seam, lying eighteen and a half fathoms below the former.

13. Coal.—This bed lies within three feet of the surface, at Bannockrigg, where it is three feet thick. At Sherrifhall (No. 36 pit) it is within seven fathoms of the surface, and forms the uppermost coal—but it is only two feet in thickness. At Castlesteads it is 3 ft. 5 in., and lies five and a half fathoms below the thirteenth coal seam.

14. Little Eldin, Glass, and Salter's Great Coal.—On the shore at Joppa, where the beds are highly inclined, the seam is about eight feet thick, including four feet of clay. At this place it lies eighteen fathoms two feet below the eighth coal. At Niddry this coal measures 4 ft. 10 in.; at Sherrifhall, 2 ft. 4 in.; at Eldin, 1 ft. 9 in.; at Skelty Muir, seven feet; at Bannockrigg, 2 ft. 5 in.; at Whitehill, where it is the upper coal, eight feet; at Rosewell village, six to nine feet; Bridgedean, nine feet; Cowpits, two and a half feet; and at Castlesteads, where it is five fathoms below the fourteenth coal, two and a half feet.

15. Eldin Rough or Barr's Coal.—This is the uppermost coal at Sommerside, Rosewell, Jewelpit, and Pinkieburn, where it is respectively 3 ft. 10 in., four and a half feet, and four feet thick. At Sherrifhall (No. 36), it is twelve fathoms below the Little Eldin coal, and two and a half feet thick; but in pit No. 27, it is three and a half feet. At Sommerside the distance is only six fathoms, and measures 3 ft. 10 in.—the general distance is, however, from ten to twelve fathoms, and the average thickness about four feet. The following are the localities, with the thickness at each; Eldin, four feet; Polton, 3 ft. 3 in.; Skelty Muir and Bannockrigg, 3 ft. 4 in.; Whitehill, three and a half feet; Rosewell village, three to three and a half feet; Barleydean, 4 ft. 10 in.; Pinkieburn, four feet; Cowpits, three and a half feet; and Castlesteads, five and a half feet.

16. Nine Feet, Sommerside, or Eldin Splint Coal.—This coal lies three fathoms below No. 15, in Sherrifhall (No. 36) pit; and two fathoms four feet at Sommerside. The distances are from eight feet to six fathoms; its localities and thicknesses are—Joppa, 6 ft. 7 in., with two feet of clay; across Brunstain and Duddingston, 6 ft. 7 in., including two feet of clay; New Craighall, five and a half feet; Niddry, five feet; Sherrifhall, 3 ft. 10 in., Sommerside pit (No 1), three and a half feet; Eldin, Polten, Whitehill, Rosewell village, Barleydean, and Aikendean, two and a half feet; Skelty Muir, two and a half feet; Bannockrigg, ten feet; Pinkieburn, 2 ft. 5 in. to four feet; Cowpits, three feet; and Castlesteads, three and a half feet.

17. Coal.—This seam at Eldin is only eight feet below the last mentioned coal; at Whitehill it is five fathoms two feet; at other places it occurs at intermediate distances. The thickness varies from two to four feet. It is found at Sherrif hall, two feet; Sommerside, two feet; Kelty Muir, three feet; Whitehill, four feet; Rosewell village, 3 ft. 5 in.; Barleydean, two and a half to four feet; Aikendean, nine inches thick.

18. Fifteen Feet, Eldin's Jewel, and Cowpits Six Feet Coal.—The following table will show the thicknesses acquired by this very important coal bed in different places:—

Localities.	Distance. Fms.	Thickness. ft.	in.
Joppa and Duddingston	0	15	0
New Craighall	0	6	0
Sherriffhall	0	4	0
Niddry	5	7	0
Sherriffhall (No. 36)	14	3	0
Sommerside (No. 1)	14	1	10
Skelty Muir	15	3	0
Whitehill	6	3	4
Rosewell Jewel pit	6	3	4
Aikendean	21	4	0
Polton	6	10	0
Bannockrigg	6	3	0
Pinkie house	6	6	0
Cowpits	6	5½	0
Castlesteads	6	5	0

This coal sometimes contains a few inches of parrot or cannel coal, as at Rosewell, Whitehill, Skelty Muir, and Aikendean.

19. Jenny Meggat's, or Four Feet Coal.—The distance of this seam from the fifteen feet coal varies from eleven to twenty-five fathoms; at Bannockrigg it is seven fathoms; at Joppa, twenty-five fathoms; at New Craighall, fifteen fathoms; Niddry, thirteen and a half fathoms; Sherrifhall, twenty fathoms; Sommerside, fifteen fathoms from the surface; and at Melville Castle, twenty-two and a half fathoms. The thickness varies from two and a half to four feet.

20. Upper Melville, or Seven Feet Coal.—The distance of this coal from the last mentioned seam is from four to eight fathoms; at Joppa it is fifteen feet thick, including two bands of stone six and a half feet thick, leaving eight and a half feet of coal—these bands at Duddingston thicken to nine feet. At Niddry the seam narrows 5 ft. 4 in.; at Sommerside, four feet; and at Melville Castle, 2 ft. 10 in.

21. This coal is situated six fathoms below the Upper Melville coal, and is three and a half feet in thickness.

22. This is a thin coal, known in Newmills level, and Bryant's pitonly.

23. This coal occurs in Newmills level, two fathoms one foot below the last mentioned seam. Here it is only 1 ft. 4 in. in thickness; but at Magdalene pans and Gilmerton it measures three and four feet.

24. This seam is only six inches on the shore at Joppa, but at Gilmerton it is 2 ft. 4 in., and is twenty-four fathoms distant from No. 24; at Newmills, the distance is said to be forty-five fathoms, and the thickness only seven and a half inches; at Bryant's it measures one foot in thickness, and the distance is seventeen fathoms. The strata underlying this seam contains no coal at Joppa for 111 fathoms; at Magdelane pans for seventy-five fathoms; nor at Gilmerton for forty-one fathoms; but at these distances in each of these places, there is the three feet stratum alluded to at the commencement of this article, called the Caldcoats limestone.—The remaining beds of limestone and coal will be noticed in the next article.

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(1) *Lithological.* From *lithos*, a stone, and *logos*, a discourse—pertaining to rocks. (2) *Stigmaria ficoides.* A plant which occurs in almost all the beds of a coal field, frequently with the leaves spread out from the stem in a parallel and in a horizontal direction. The stem is marked by alternating dots or scars, to which the leaves are attached. The leaves are long, and from a quarter to half an inch in breadth. The stems are sometimes found of great length, round, or compressed. The stigmaria is considered to have been an aquatic plant. (3) The *Lepidodendra* have beautiful rhomboidal scars—are like those formed by the scales which compose the cone of the larger or common fir. The leaves are often attached. (4) The *Sigillaria* have fluted stems with alternating scars of different shapes. (5) Calamites. Plants allied to the equiseta, or horse-tails.

* Continued to the *Mining Journal* from the *Glasgow Practical Mechanic*.

ABSORBENT ARTESIAN WELLS.

The operation of boring into the permeable strata of the earth has been long employed for the supply of water, but a novel application of boring is now being tried in various parts of France, within the circle of the Paris Basin, and in almost every case they have been successful—it is that of making an Artesian well the means of carrying off the waste water where there is not sufficient drainage; from this practice some very interesting facts have come to light. A manufacturer, for instance, in the Fauburgh St. Marceau, endeavoured to get rid of the waste water from the engine, by sending it into an old well which was not used; for a length of time this produced no inconvenience, but, after the lapse of a few months, the water in the neighbouring wells became so warm as to be quite useless for general purposes, and he discontinued the practice in consequence; it was then eighteen months before the water in the wells got back to its original temperature. As long ago as 1790, the Hospital of Bicetre has been divested of its waste water, by being turned into some old quarries in the neighbourhood; to obtain a perfect infiltration, the architect dug a well, forty five feet deep, from the bottom of the quarries, and this has ever since carried off all the waste liquid; all the wells in the immediate neighbourhood are, however, in some degree, affected by it; and, in several cases, parties have sunk their wells into the next permeable strata, to prevent the water being infected. From the experiments which have taken place, the most important results are anticipated, in an engineering point of view—marsh land may be drained by these means, and thus rendered productive; and it is suggested that London, and the whole of its environs, might be drained by absorbent Artesian wells, and the water of the Thames thus left perfectly pure; there is no doubt but such a plan, if adopted, would conduce much to the improvement of the public health; and it is considered, by scientific men, that the water, by its filtration, loses the greater part of its impurities, and that water from wells, in many cases even in the same strata that drainage water is turned into, will be quite clear and wholesome. Connected with this subject is the temperature of water at various depths. Dr. Paterson has made a series of experiments on the wells of Mid-Lothian, Stirlingshire, and Clackmannanshire, from which the following results are arrived at:—

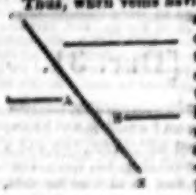
	Feet deep.	Temp. Fahr.
A well in the parish of Bothkennar	120	49
A spring at Kennetpans	180	49
Ditto at ditto	210	51
Ditto at Kerse	261	51½
Ditto at Kennetpans' distillery	270	51½
Ditto at Mr. Brown's house, at Kennetpans	300	52

From these, and a variety of other facts of the same nature, which have been noticed in various parts of the world, the average rate of increase appears to be 1° Fahrenheit for every 59·1 feet in depth, while the average of the springs noticed by Dr. Paterson, in Scotland, is 1° for 47·11 in depth.

Convenient Test for Chloride of Lime.—The properties indicated by copper, when acted on by sesquichloride of iron dissolved in hydrochloric acid, as stated by Fuchs, may be applied as a test for chloride of lime. An accurately weighed quantity of chloride of lime is infused with water, and a solution of recently prepared simple chloride of iron then added in excess. No chlorine is evolved during this operation; but a quantity of oxide of iron forms, exactly corresponding to the contents of chlorine; hydrochloric acid is then added in excess, a weighed piece of copper put into it, and the liquor boiled until its dark colour changes into a pale yellowish-green, without further alteration. The copper is then washed, dried, and weighed, and the quantity of chlorine calculated from the loss of weight—64 of copper indicating 35·5 of chlorine. Such an experiment is executed in from one to two hours, and is best undertaken in a small retort, heated in a sand-bath, with the neck arranged perpendicularly.—*Arch. de Pharm.*

MINING NOTICES.

Within three or four years we have from time to time given brief notices of the peculiarities and mineral productions of the various mining districts of Cornwall, together with some details of the circumstances which seem to influence the richness and poverty of the lodes. It is now our purpose to present some remarks on the intersections of lodes by cross-courses and flookans, and on their results, which are by geologists termed "dislocations" or "displacements," but by practical miners in this county they are called HEAVES.



Thus, when veins having different directions (as, for example, a lode and a cross-course) intersect horizontally, and one cuts through the other, if the several portions are not found exactly opposite to each other on opposite sides of the vein by which they are intersected, a heave is said to have taken place. And the heave is said to be either a right-hand or a left-hand heave, A B or A C, according as the severed portion may be re-discovered by turning in one or in the other direction. For it must be observed that on whichever of these divided parts the cross-course, Z, is approached, the other part is found by turning towards the same hand. Another circumstance is that the heave may either be towards the greater angle, A B, or towards the smaller, A C, unless, indeed, the veins stand at right angles to each other.

Now, if the miner be digging horizontally (driving) on the lode, A, towards the cross-course, Z, he will find on intersecting it that every trace of his lode has disappeared, and that he has encountered another having a different direction, and probably of utterly dissimilar ingredients. We have already mentioned (in a previous paper) that lodes are frequently productive in the immediate vicinity of cross-courses, and in such cases, of course, it is of the utmost importance to find the lode on the opposite side. Sometimes, indeed, traces of the lode are visible in the cross-course, and the direction in which they occur indicates where the lode may probably be discovered. This, however, is far from generally the case; and where there is no such guide the recovery is one of the most perplexing, puzzling, and difficult matters which the miner has to encounter, and has caused more vain and fruitless expense than any other department of mining.

There is no general rule yet known which is uniformly pursued by every mine agent in every part of Cornwall; and as there are great differences of opinion prevalent among the best informed and most experienced men in the same neighbourhood, and sometimes even in the same mine, we venture on the subject with many doubts and much hesitation. Nevertheless, as we have before us the results of several hundreds of intersections, collected with the greatest care in every part of the county, we shall proceed to submit the conclusions to which they lead, with the hope that if we do nothing more we shall remove some uncertainty, and if we are unable to give absolute precision we may induce some of our practical friends to favour us with their observations. In the first place, we shall speak of the proportions of the heaves in different directions of lodes, yielding the ores of different metals.

Of all the lodes intersected by cross-courses the proportion simply intersected, but not heaved, is about	27	per cent.
Heaved towards the right-hand	51	"
" left-hand	25	"
" greater angle	60	"
" smaller	12	"
Of the lodes yielding tin ore only, the proportion simply intersected is about	26	"
Heaved towards the right-hand	56	"
" left-hand	20	"
" greater angle	57	"
" smaller	20	"
Of the lodes which afford both tin and copper ore, the proportion simply intersected is about	37	"
Heaved towards the right-hand	44	"
" left-hand	19	"
" greater angle	56	"
" smaller	7	"
Of the lodes which contain copper ores alone, the proportion simply intersected is about	18	"
Heaved towards the right-hand	55	"
" left-hand	29	"
" greater angle	74	"
" smaller	8	"
The mean distances of the heaves which have come under our observation, are about	16	feet.
Of the tin lodes	14	"
Of the lodes yielding both tin and copper ores	14	"
Of the copper lodes	17	"
Of the heaves towards the right-hand	19	"
" " left-hand	13	"
" " greater angle	16	"
" " smaller	17	"

The practical application of these results seem to be the following:—Taking the copper lodes, more than one-half of them are heaved towards the right-hand, whilst nearly three-fourths are heaved towards the greater angle, including, of course, in this proportion, most of those heaved towards the left-hand, as well as the larger number of those heaved towards the right. Less than one-third of the copper lodes are heaved towards the left-hand; and not quite one-fifth of them are simply intersected without being heaved, whilst less than one-twelfth part of their number are heaved towards the smaller angle. With regard to the extent of the heaves, those of the copper lodes seem rather to exceed the average; the right-hand heaves are considerably beyond, and the left-hand ones are within the mean, whilst there is no great difference in the extent of the heaves, whether they may be towards the greater or smaller angle.

It is scarcely necessary for us to go more into detail to show our practical friends how to render these numbers available. In a future paper we shall proceed to show the differences in the effects of cross-courses and flookans, not only as regards the directions, but also the distances of the heaves, of various lodes.—*West Briton.*

COPPER MINES IN JAMAICA.

We have received, by the last packet, some Numbers of the *Royal Gazette and Jamaica Standard*, in which several letters appeared, treating on a mine called the "Mount Vernon Copper Mine." In a late Number we made an extract, and now propose noticing those articles which were then passed over until an opportunity presented itself of giving them a careful perusal. That the island of Jamaica holds out prospective advantages to the capitalist who may direct his attention to its mineral resources we entertain no doubt, from the several authorities to which we have referred, specimens that we have seen, and the accounts received from parties who have located in that island, but that many difficulties are attendant upon operations in that clime, and that much caution is essentially necessary must be admitted by even those who are most interested in its mineral resources being developed. In reviewing, then, the several articles which may come under our notice from time to time, we shall studiously avoid lending ourselves to the views of interested parties, and, if we be deemed over scrupulous in giving credence to all we read or hear, we shall, at least, have the satisfaction of knowing that we err on the safe side. The first letter or paper to which we will make reference, is under date 3d July, from which we learn that the writer was "not a little surprised at the magnitude of the excavations already effected," which, from the description given, is rather amusing, when the writer speaks, by way of comparison, of the mines of Cobre, which he visited three years since, the copper ore, in appearance, being much richer than that of Cuba—the mines in the latter island, we are told, having been losing concerns for years, although now so highly productive. The writer further informs us, that copper abounds in these (Port Royal) mountains, as evidenced every day. At Flamstead, two tons of ore were raised daily, and even on the roadside, on Dublin Castle, there are "the usual indications" of copper, which are plentiful—indeed, says he, "we cannot visit an overseer's house in the district without being solicited to inspect specimens of copper ore picked up by the negroes without much research." The next communication before us is dated August 14th, and is addressed to the Editor by W. Arnold, M.D. This gentleman, who visited the mine with the object of making a scientific and practical survey, the notes on which we inserted in a late Number, leaving out all such matter, which, however valuable to those whose capital is invested in the island, or who are otherwise interested, we considered, appeared to us unnecessary for the object in view. The district he says, "abounds with copper to a great extent;" "the whole of the rocks are metalliferous;" and then proceeds to describe the several workings, extracts from which appeared in a late Number. Having, as with [illegible] made copious extracts from Dr. Arnold's memoir, we proceed to a report of the proceedings of the directors, at a meeting held in Kingston, on Tuesday, the 7th September. From the minutes of such meeting it appears that Messrs. Barnes, and Dunn, who seem to be the proprietors [illegible] parties, formed a company, the shares in which were not, however, subscribed for, [illegible] that the report states they had "offered to abandon their right to [illegible] from the sales of shares belonging to the company, and also to one-third of the shares which have been sold, but are not yet paid for, upon condition that they (or those to whom they may dispose of their own shares) shall not be liable to any calls made by the company until the proceeds of the remaining shares, when disposed of, shall have been expended in working the mines," which offer was accepted by the directors; so that, as is tritely observed, "the entire amount which these (surplus or unsubscribed shares) may bring either here, or in the mother country, will be applied to the proving of the mine." An extract from a letter received from Messrs. Grenfell and Sons, with particulars of produce of ore sent to Swansea, was submitted—the quantity being 1 ton 0 cwt. 1 qr. 8 lbs., which, we presume, was sent as sample, to ascertain the produce; of this 17 cwts. yielded 17 produce, 3 cwts. 24¾, and 1 qr. 12 lbs. 20¾ produce. We are told that Mr. Jenkins, the agent of Messrs. Grenfell at Swansea, says—"the ores are much of the same quality as the Cobre ores, and *if* the mine be as productive as that, it will turn out a good speculation." The sagacity of our friend Mr. Jenkins is duly appreciated, and another truism is put forward by the directors, who say—"the only mode by which it can be ascertained whether the mine be as productive, is by working it, and we should *hope* that the remaining shares will be shortly taken, so that that this may be done." In closing our notice of this meeting—for we have no data beyond that given on which to ground an opinion—it is only right we should take the concluding paragraph of the report before us, which is couched in the following language:—"We wish some of those who may be disposed to engage in such speculations would put an agent on board one of the steam-packets, and send him to see and report from actual observations; if they would do this they would be *convinced* that the Mount Vernon Mine is as promising as the Cobre Mines ever were." This is "smart," as the Americans would say.

MINES OF ALMADEN.

MADRID, DEC. 5.—The little *pueblo* of Almaden contains a population of about 5000, of all ages, capable of working in or about the mines; for all who can handle a hammer, or carry the smallest basket, find occupation in the various works, either under or over ground. The entire establishment is, in effect, a royal colony, the creation of which was for a long series of years attempted by forcible means—the employment of condemned criminals, &c.; and it was not until the nineteenth century had dawned that the Spanish Government could be convinced that the cost of their chain-labour system overbalanced the value of the quicksilver produced, and that all they wished to accomplish, could be obtained by the honest payment of fair wages to free labourers. The presidarios have now been withdrawn for the last forty years, and a sufficiency of candidates for occupation have never since been wanting. Experience has shown that the labour in the mines can be pursued with less danger in the spring and winter months than in the heats of summer and autumn; and all engaged, are freely allowed to quit the mines, and to occupy themselves, as long as they please, in agricultural pursuits. The suffering miners may be seen at the end of spring hobbling off on crutches to Andalusia, Estremadura, Galicia, and Portugal, and returning, six months afterwards, comparatively stout and capable of renewing their toils. But the fact is, that the diseases inflicted by labour in these mines are never radically cured in those who continue to expose themselves to the influence of their pernicious vapours. Even the governor and the engineers feel the deleterious effects encountered in their visits of inspection; they no longer can write a firm, steady hand, and their legs confess the weight of their bodies, as they climb the long ladders. The governor has very prudently shut up for the present the "most poisonous veins" of ore, containing the chloride of mercury, and keeps all hands occupied at the less dangerous cinnabar; but still the effects are lamentable, and many of the miners may be seen, still in the prime of their age, incapacitated from using their hammers by continual tremblings and convulsions, employed on surface works like children, and, in fact, reduced to a state of second childhood.

There are no pensions for disability in this species of public service in Spain (and in the army the pensions are left unpaid by the empty treasury, so that it comes to the same thing), and these unfortunate "victims of the mine" are left to depend for subsistence upon the good nature and good management of the governor, who, I am *happy* to say, does everything in his power to alleviate their condition, and to extend to them the means of a comfortable subsistence. He has little territory to preside over, but which, for its extent, comprises more responsibilities than perhaps any other in Spain; and it was pleasing to see that he was fully equal to it, pursuing, as he does, the excellent custom of looking after everything, from the top of the Sierra (where he is now intent on planting a forest, to supply the mine with timber in after years) to the bottom of the mine, which has now been sunk to the ninth level. In short, Don Casiano de Prado is his own engineer of mining and planting, his own administrator of finance and public works, and everything prospers accordingly. He is one of the few great functionaries in Spain who have been educated for the position they hold, the majority (especially the politicians) being content to find the places created for them. Occasionally the alcalde of the *pueblo* (who drives the mules of the mine) comes to him with a patriotic deputation and *pronunciamiento*, full of *fomento de la industria mineral* and *Espanolismo*, and all that, giving him, unasked, most statesmanlike advice on the part of all the blasters, pumpers, stone-breakers, and road-menders, for the better government of Almaden, and liberally proposing to undertake it themselves, to which the governor listens most politely, informs them that the responsibility rests on his head alone, and then dismisses them to their several tasks, with the consciousness of having "done their duty to their country." Spain is still in a state of most anomalous transition from arbitrary government to constitutional; and great allowance must be made for her uninformed population when they commit themselves in these Quixotic attempts on Royal estates. But to descend into the mine; the interior resembles a series of streets more than veins, many of them fourteen feet wide, and several hundred feet in length, whence the cinnabar ore has been extracted.

The admirable plan on which the works are conducted in solid masonry, to fill up the vacuities not required for passages, would require drawings to execute; but I may safely say that there is nothing even in England superior to them for extent, massiveness, and workmanship. Many of the arches (some thrown across a breadth of thirty feet, askew) would not disgrace the flying viaducts of English railways. The miners call them emphatically *las obras* (the works), and appear to take more pride in them than in their mercurial veins, or rather masses, of cinnabar. They are all bred to masonry and carpentry, and find their callings healthful and profitable relaxations from the severer toil of mining, the fatigue of which may be judged of by the fact that sometimes twenty-five *barrenos*, or jumpers, are blunted in piercing ten inches into the quartz rock through which the cinnabar is disseminated. This generally takes six hours' labour, after which the blasters charge and fire their charges, and retire, not only for the day, but for three days, to recover the effects of their unhealthful toil. Working, as they do, by contracts taken at public auction, their six hours' work procures them 3½ pesetas, or 7-10ths of a dollar—little enough to exist on for three days.

The want of water-power imposes severe labour on man and mule in raising the ore and water, but the special and crying evil of the mine is the quantity of mercurial vapour which exhales at all times—aided, no doubt, by the numerous powder-blasts (for every pound of ore is obtained by boring and blasting) and the lamps kept constantly in use. The passages are so high and wide, and the ventilation is naturally so good, if I may be permitted to say so, that until recently no attempts have been made to direct or improve it, and I even found the old miners impressed with the idea that "the more wind is sent through the workings, the more quicksilver it will raise, and the more injurious it will be to breathe." However, I was happy to find the governor fully aware of the value of the English coal-pit system of ventilation, and preparing to put it in practice in Almaden. He has been but a comparatively short time yet in office, and, already, great reforms are visible, especially in the economy of the establishment. Last year he obtained the usual quantity of quicksilver at the cost of a million of reals less to the Treasury. At present everything presents the appearance of forethought and careful management. Two heavy forges and two quarries are daily at work; the stores are full of fuel and building materials; and, better still, the magazine of quicksilver is empty, all having been safely delivered to the contractors at Seville, and placed beyond the reach of thieves and smugglers, who flourish in Almaden as well as in other parts of Spain.

MANUFACTURE OF OIL OF VITRIOL FROM IRON PYRITES.—The manufacture of sulphuric acid and soda is carried on conjointly, in a factory at Belgium, in the following manner:—The residue of the roasted pyrites are mixed with an excess of sea-salt, having previously ascertained the contents of sulphate of iron contained therein. The mixture is then heated in an appropriate furnace, arranged so as to collect the muriatic acid. The sulphate of soda formed, is obtained by solution and crystallization; the peroxide of iron remaining is separated by elutriation into two parts; the most finely divided is dried and mixed with grease or palm oil, serving as a lubricant for machinery, for which it is admirably adapted; whilst the coarser portions are made into balls, dried, and used as mineral iron for the puddling-furnace. In factories where soda is not made concurrently with sulphuric acid, in place of procuring the sulphate of iron from the roasted pyrites it will be more advantageous to distil these residues, the sulphate of iron being first dried, so as to obtain the fuming sulphuric acid of Nordhausen, as it is termed. It would be very easy to arrange the apparatus in such a manner that the sulphurous acid, arising from the decomposition of part of the sulphate of iron, should be conducted into leaden [illegible] or chambers. By such an arrangement, nothing would be lost, since the colcothar, or peroxide of iron, remaining after the process has been completed, is always available.

ECONOMIC GEOLOGY.

ON THE MECHANICAL STRUCTURE OF SOILS.

If the external covering of our planet was removed, so as to lay bare the framework of its surface, and expose it to the influence of those physical agencies which appear to be momentarily altering its external aspect, what would be the progress of adaptation which its surface would undergo to fit it for the occupation of man, and the production of those articles on which he subsists? A complete solution of this problem would show in what way the most fertile soils have been brought to their present condition, the component elements of which they are constituted, and the state of mechanical division and chemical aggregation which subsist together in order to constitute them what they are. It is only by the imitation of the laws of Nature that man can expect to produce her results.

We shall first consider some of those conditions of soil which seem most essential to luxuriant vegetation; we shall then be better able to consider and estimate the circumstances which produced them, and also to imitate them, or set to work natural processes to do so. The fertility of soils depends, then, on a variety of conditions and circumstances, so that a soil of considerable fertility in one situation might be sterile in another, and vice versâ—that is, as far as their constitution is concerned. It is evident that a soil which occupies a rapidly sloping situation should be more retentive of moisture than one which covers a level plain, and also one resting on impermeable clay or rock should differ from one reposing on gravel or a porous subsoil. This necessary difference arises not only from the more or less permeable nature of the subsoil, but also from its more exposed situation, and from the greater liability of the water to run off under such circumstances than the other. Not only must soils be permeable by, and retentive of, water, but also permeable by air. This is the agent by which all the most important changes in the constituents of organic matter are principally effected, and fitted to be assimilated by their organs, from the first germination of the seed to the mature growth of the plant. The constituents of manures are rendered soluble, carbon becomes carbonic acid gas, and is then in a fit state to be absorbed; this evidently results from the oxygen of the atmosphere being in a free state, and constantly ready to be combined with all those constituents which it comes in contact with, and for which it has an affinity.

There is still another agent, whose influence is not less necessary to vegetable development, and this influence depends in an important degree also on the constitution of the soil. If the interstices of the soil are filled with water, the first influence of the sun in spring will be long employed in converting this into vapour before the soil can be much warmed. This most important influence will be long lost before its effects are felt in giving energy to vegetable life, for it is a well-known fact that a great amount of heat is rendered latent by the conversion of water into vapour. The colour of soils also has a considerable influence in relation to heat; black, for instance, is about four times more heated in the same time than any other, but it appears to be not quite so retentive. Some of the conditions, then, that obtain in a good soil are the following:—It must be permeable by air and water, and highly retentive of the latter; and here it must be observed, that there is a great difference between a soil which is retentive of moisture and one which is so saturated that the water might be pressed out with the hand. When apparently dry, soils should contain from one-tenth to one-fifteenth of their weight of water, and this is so intimately mixed with them, that a high temperature is required to free them completely from this admixture. Now, this property of retaining moisture results chiefly from the minuteness of the particles of which the soil is composed; if these be large it will retain very little, and this will be dissipated into the state of vapour in a few hot days. This is principally the cause of the sterility of sands. Again, while this retentive property of a soil depends upon the component particles, its permeability by air depends chiefly on the opposite; there will, therefore, be a due degree in which they must exist together, to render a soil in the highest degree fertile. It is also evident in what way the draining of [illegible] subsoils acts, and also its utility where porous, as the soil must be emphatically cold when it is constantly saturated with water. But this also may be in the extreme; if a subsoil be too open and loose, all manure, and the most valuable part of the soil, will be carried away, and this will emphatically constitute a hungry soil. Soils have frequently been analysed, and inferences drawn from their constituents have differed materially from the truth. We do not mean to state that the quantity of the different earths in a soil is quite a matter of no importance, but, compared with the size and proportion of the different particles of a soil, it is by no means of the greatest consequence. It is the very minute size or impalpable state of the particles of a soil that renders it retentive of manure and moisture, and it is the presence of larger particles which renders it permeable by air and water. It is true that the particles of calcareous, and especially of aluminous, earths, are generally in this impalpable state, with a portion of siliceous earth, and then its effects are nearly the same. On looking over the analysis of soils reputed highly productive, it is surprising to find how widely they differ in their constituents; a few are selected from Sir Humphry Davy's *Agricultural Chemistry.* Calcareous earth three quarters to one-twentieth, aluminous ditto one-half to one-twentieth, siliceous ditto one-half to one-twentieth; and, generally, chemical analysis is not necessary to ascertain the quantity of the different earths, for, unless they are palpably abundant, it does not appear to be of great importance; hence, practical agriculturists, judging from the mere appearance of soils, have sometimes formed truer conclusions than chemists, judging from the constituents.

Having now briefly considered some of the principal conditions of fertility in soils, we shall return to the point from which we set out. And, first, what effects would have followed the influences of physical agencies, such as we have supposed. Such agencies of course have always existed, but they acted originally with more of youthful vigour, while the effects we now see are those of an infinite series, whose first terms have been constantly exhausted by the constant subtraction of some expended power. When we view recently exposed strata, we see its surface indented with numerous hollows and furrowed by various ridges, and where these are sharp and well-defined, we may infer that it has been subjected to little of the abrading influence of the atmosphere. This, no doubt, presents a miniature picture of the earth's surface before it was clothed with the various earths which now give it that beautiful flow of outline and gradual descent from hill to valley. Some of the masses which are now seen as hills, had probably all the features of the mountain districts, from which all soil has been carried away as fast as formed. Others again having been disrupted from beneath, or covered by volcanic agencies with the products of igneous action, their surfaces would be in a condition to be pervaded by meteoric influences.

Most rocks contain iron in the state of protoxide, and as air and water come in contact with this, there would be a tendency in the iron to enlarge its volume by uniting with a larger portion of oxygen, so as to become peroxide, and this tendency is exerted with so great a force as to detach portions from rocks containing iron. Water also enlarges its volume with a similar power when frozen, its volume is increased about one-twelfth, and as it permeates all porous rocks more or less, the degree of disintegration resulting from it would be considerable. Winds, too, assist in the work of comminution by driving particles with violence against rocks and each other. But it is to watery agency in the form of floods, waves, currents, tides, and rains, that we must chiefly look for a modifying influence on the past condition of our globe. That large portions of it have been permanently submerged is quite evident from the water-worn appearance of the sides of some mountains containing caves, fissures, and an appearance perfectly similar to the cliffs of the sea-shore, and further from the universal prevalence of rounded portions of the various rocks. The origin of this superficial covering of our earth is, therefore, clearly referrible to such causes for its existence in this state of mechanical division. There is yet one general constituent of soils of which we have said nothing; it is that substance which results from the decomposition of organic structures, and which has been called humus, vegetable earth, &c. Some portion of it is essential to great fertility; this portion, however, admits of great latitude, from a mere trace to a considerable proportion; but about 8 or 10 per cent. appears to be the best.

In a natural course of vegetation there is a tendency to increase this element beyond the extent required to vigorous vegetation; and, hence, the existence of peats, morasses, &c., which are prevented from further decomposition by the presence of tannin, also a vegetable product. In this state vegetable earth is quite inert as manure. Soils may, however, be freed from this principle, because tannin is soluble in water, when lime, and caustic lime has a greater affinity for the earth than for the tannin; therefore, by mixing with lime the organic matter is rendered free from the antiseptic principle of tannin. From these considerations it appears that the water draining [illegible] manures must be injurious to vegetation, by preventing the [illegible] the organic matter on which their nourishment depends. [illegible] the various constituents of rocks and earth presents [illegible] to the growth of plants. We have already intimated the [illegible] of vegetable earth; but from the almost total dependence of vegetable growth [illegible] this, it merits further notice. Plants contain only a small portion of the [illegible] other earths in which they grow, generally not more than one-[illegible] When plants are subjected to combustion, it is a well-known fact that [illegible] of their substance is lost. The earths, however, are indestructible by [illegible] in the argillaceous, calcareous, siliceous, &c.; hence [illegible] evident, that a very small portion of these are necessary to their growth [illegible] constitution; they furnish little more than a laboratory, in which it [illegible] the essential process of preparing matter to be received into the [illegible] of the most minute parts of plants, where the vital process begins; and it cannot be too emphatically stated, that it is upon the [illegible] facilities of the soil that the luxuriance of vegetable life depends. It [illegible] appear that the quantity of humus in soils is usually quite sufficient to [illegible] with materials for the growth of several crops, if the soil were rightly [illegible] tilled, and the humus not combined with any substance which prevents its decomposition.

In relation to irrigation, these considerations are necessary:—1. If the water hold in solution any substance capable of improving the soil. Water dissolves lime, so that if it has passed through or over calcareous earths, it will, on being spread in a thin sheet over the surface of the ground, attract carbonic acid from the air, and carbonate of lime will be precipitated. This will improve the texture of all soils which are too loose and porous; but it must be observed, that there is a great difference between lime in this its neutral state and caustic lime; the latter has powerful affinities, which it exerts on humus, if present, by uniting with its carbonic acid, leaving the remainder in a soluble state. With the partly decomposed fibres of vegetable matter, such as roots and stems, it acts in a similar manner. Now where these sources of saturation are not at hand, it remains partly caustic in the soil, depriving the roots and germs of seeds of their support, and also absorbing carbon and oxygen from their living tissues. In the one case it is beneficial, in the other injurious. All applications of powdered limestone are similar to that supplied by irrigation, improving only the texture of the soil. 2. If water hold suspended particles of the various earths under the same circumstances as the preceding, they will improve the condition of the soil in relation to its mechanical texture. But as vegetable earth and some salts are generally contained in the water, they will be deposited as the water percolates through the soil, and will act as manures. 3. The supply of moisture which it furnishes is highly useful as a solvent. It has also been stated, that plants deposit by their roots a refuse portion of sap, which is injurious to the healthy action of their functions, and that irrigation removes this by washing the soil. The chemical and mechanical agents exerting their various physical powers, then, on the numerous rocks which constitute the surface of our globe, have decomposed some and abraded others, intimately mixing in some cases, in others aggregating them, and it is for man to perfect this process where Nature has not done so. She has furnished him with sufficient specimens and materials in abundance. The decomposition of granite has furnished probably most of our clays, since felspar consists principally of argil, with about 14 per cent. of potash. Silica is abundant in almost every rock, and the calcareous earth is furnished by every form of carbonate of lime. Rivers rushing from elevated districts, loaded with the spoils of the rocks over which they had passed, and descending to a situation where the violence of their motion was diminished, would first deposit the heavy matter, and, where the waters become still, the most minute. This is no doubt the origin of our alluvial plains, consisting of nearly all the earths in a most minute state of division; and the extent to which they crack, when subjected to heat, shows the degree in which they retain moisture.

ON THE PREPARATION OF CARBONATE OF BARYTES, AND ITS USE IN THE FABRICATION OF SODA.

Of all the methods proposed for decomposing heavy spar, the two following are the cheapest and most perfect:—1. Heating the pulverised heavy spar with one-eighth charcoal powder and one-fourth wheaten flour, or colophonium, in covered crucibles, and heating again the powdered product formed into balls with one-eighth charcoal and water, and placed between layers of charcoal. The brownish grey mass which is obtained affords, with hot-water, a solution from which the sulphuret of barium easily crystallises. The sulphur is best removed from this solution after the method of Vogel, by continued boiling with a mixture of the oxide and dioxide of copper, and the solution then contains caustic barytes. In preparing the chloride of barium an excess of hydrochloric acid must be carefully avoided, and the crystals cleansed by washing and recrystallisation. 2. Fusing two parts heavy spar with one of chloride of calcium (Driessen), or four heavy spar, three chloride of calcium and one dust of iron filings (Duflos), in covered crucibles; the cold and powdered mass is then extracted with hot-water, the mother ley exposed to the atmosphere, filtered, and the chloride of barium left to crystallise. The solution of caustic barytes may be very advantageously employed in preparing caustic potash or caustic soda from their sulphates. The preparation of the carbonate of barytes may be from the chloride of barium by means of carbonate of ammonia, when sal ammoniac is obtained as a collateral product, or by means of carbonate of lime. The last method is of importance in the manufacture of soda from the sulphate of soda and carbonate of barytes, according to Kuhlmann. The author convinced himself that heavy spar might be decomposed, even in the cold, by triturating with carbonate of lime and water. An experiment made with 122 grs. heavy spar and 50 grs. carbonate of lime and 2 oz. water, only afforded 5·2 grs. carbonate of barytes; but if water, impregnated with carbonic acid (6 oz.), was employed instead of pure water, and the whole left to stand (being frequently shaken) for fourteen days, 32 grs. carbonate of barytes were obtained; 99 grs. should have been obtained according to theory, and this complete decomposition would, probably, be attended at low temperatures. The author attempted, under similar conditions, i. e., contemporaneous use of carbonate of lime, carbonated water, and low temperature, to decompose the sulphate of barytes direct. He succeeded in obtaining small quantities of carbonate of barytes, but only when the salts were finely divided and by continued trituration; he obtained most in one experiment with freshly precipitated carbonate of lime and levigated powder of heavy spar at from 5° to 6° Fahr., in which about one-sixth of the heavy spar was decomposed. —M. Weiss; *Arch. der Pharm.*

FLUCTUATION IN THE VALUE OF JOINT-STOCK PROPERTY

Mr. John Greaves, sharebroker, of Liverpool (to whom we are indebted for our weekly list of current prices at that town) has just forwarded us his annual statement of the highest and lowest prices of shares in the leading railways, banks, and other property for investment, which gives much data of an important character; thus the greatest extreme difference in railway shares will be found in Great North of Englands, which have varied during the year from 57½ to 22—a difference of 35½, and the present market price being 30½, shows a decline since April last of 26½ per share. The lowest difference during the year is in Eastern Counties, which is only 7½, the highest price having been in April 10½, and in November 3 per share, the present price being 6¾. London and Birmingham have varied 24, the highest price being 194. Great Western 14, highest price 93. Liverpool and Manchester 26, highest price 180. South-Western 7, highest 64. Manchester and Leeds 24½, highest price 90. Midland Counties 25½, highest 65. North Midland 16½, highest 73; and York and North Midland have only varied 9, the highest price being 95—thus the average extreme difference in the prices of the shares of the abovenamed ten principal railways during the past year is 18 4-10ths. In the shares in joint stock banks in Liverpool, nothing like the same extent of fluctuation is found, seven of them only varying from ½ to 3½ during the year, and the Royal Bank, with its 100l. shares at a maximum price of 203½, has varied 26½, this being less than one-tenth of the price of the shares. In the Bootle Water-Works the difference has been 20l. on a price of 216½, and the Liverpool and Harrington of 6l. on 61. The New Gas have varied 7, and the Exchange Buildings 20½. These statistical data, though but of little interest to the casual reader, are of much importance to the speculator and the proprietor of shares in different kinds of investment, as by them the effect of various circumstances connected with management, finance, &c., can be traced to its true cause, and, probably, may hereafter be the means in many cases of firmly establishing property, which, without such investigation, might be looked at with anything but confidence. The following is a comparison of the weekly average traffic taken from the 1st of July to 23d December, 1842, with the corresponding average of last year on the following lines of railway, in each case the first named sum is for 1841, and the second for the present year:—Eastern Counties, 864l.—1014l.; Grand Junction, 8217l.—7996l.; London and Brighton, 1340l.—2834l.; London and South-Western, 5292l.—6307l.; Liverpool and Manchester, 5317l.—4836l.; North Union, 1234l.—1060l.; York and N. Midland, 1689l.—1781l.

Share Jobbing in France.—The Correctional Tribunal have been engaged on a prosecution, instituted by certain shareholders in the Paris and Versailles Railway, against Messrs. Benoist, Perthuit, Achille Fould, Benoit Fould, and Leo, as directors of the company, charging them with fraud, in having employed a broker to traffic in the shares of the company, not for the benefit of the shareholders generally, but for their own private profit, and with not keeping proper accounts. The president having addressed the accused parties, they generally denied the accusation; and M. Leo said, that as the funds of the company were lying idle, he had employed them in a just and legal manner in speculation, by which a profit had accrued to the company of 90,000 fr. All the accused had lodged a counter complaint against their accusers, on the ground of defamation. The complainants required the production of the books of the company, which was opposed. The Court, at length, refused the application, and put off the further hearing of the case, condemning the complainants in the costs of the day.

Aerial Navigation.—(*From a Correspondent*).—As this subject causes much inquiry at present, and as it is understood that a company is formed for the above purpose, and a model of the machine constructed, it may be interesting to inform your readers, that Mr. Quilliams, of Ulverston, in Lancashire, several years ago completed an apparatus, on a small scale, which, when put in motion by common watch machinery, completely answered his expectations. It progressed with considerable speed across currents of air, in any direction previously given to it, and deviated but little from its path. Mr. Quilliams would, no doubt, communicate the particulars of his invention, and prove that the practicability of aerial navigation, without gas, is established.

The celebrated chemist, Berzelius, was nearly killed, a few weeks ago, by the explosion of a retort in his laboratory at Stockholm. Fortunately he escaped with some contusions, from the effects of which he had sufficiently recovered, on the 16th inst., to be able to leave his house and resume his customary avocations.

ON THE DISCHARGE OF WATER AT VARIOUS DEPTHS.

[Copy of a paper sent to the Cornwall Institution.]

BY RICHARD THOMAS, CIVIL ENGINEER, OF FALMOUTH.

In the *Mining Journal*, for the 29th of October, is an account of the drawing off the water from a mine in North Wales, in which it appears that an auger-hole, of 1 1/16th inch diameter (the hole being 3½ feet long), discharged 153 gallons per minute—the water in the mine being then 198 feet in depth above the orifice. Another hole being opened, of 1⅜th inch diameter, the discharge from the two was 386 gallons per minute—the water being then 196 feet in depth; at 130 feet depth, 287 gallons per minute; at 70 feet it was 180 gallons per minute; at 37 feet, 128 gallons; at 20 feet, 96 gallons; at 3 feet, 64 gallons; and at 1 foot depth, 37 galls. per minute.

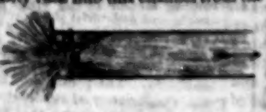
In comparing these actual discharges with the theory, we have the following results:—

The area of the first hole is 0·8866 square inches } = 2·3718.
Ditto ditto of the second is 1·4852 ditto }

Supposing there were no friction to impede the discharge, and that it could flow freely, in a cylindric form, through the orifices, then the velocities and quantities discharged in a given time, according to theory, would have been in direct proportion to the square roots of the several depths of the water, as under:—

Depth of charge in feet.	Velocity p. second in feet.	Quan. p. minute in gallons.	
198	112·84	390	—for the lower hole only.
196	112·31	664	for the two holes.
130	91·4	562	
70	67·13	413	
37	48·78	300	
20	35·88	220	
3	13·88	85	
1	8·02	49	

Now, it is well known that, besides direct friction, there is a material impediment to the discharge of water through a cylindric channel, from the manner in which the water must of necessity rush into this channel from the place of discharge, causing it to take a conical, instead of a cylindric, form, and thereby contracting the discharging stream at *a'* as shown in this sketch, and the space at *b*, round the contracted stream, will contain eddies, which will tend to hinder the free discharge even of the contracted stream; so that, could the orifice have been formed of the shape of the discharging water, more water would flow through the orifice thus narrowed than through the cylindric hole. Experiments have demonstrated this to be the case. Venturi, in his *Experimental Inquiries*, has shown it to be so. I quote one of his experiments, to compare with the results of the discharges in question. He employed a cylindric tube of 1½ inch (French) diameter = 1·5975 English inches; length 4½ French inches = 5·0587 English inches; the height of the charge of water (which was always continued at the same elevation, by a constant supply coming in, and a place for overflowing of any surplus quantity) was 32½ inches French = 2·8844 English feet; the discharge was four French cubic feet in thirty-one seconds, which is equal to 4·8310 English cubic feet in the same time, or 58¼ gallons per minute. In this case, according to theory, and allowing nothing for friction or for the contraction of the stream, the velocity of the discharge would be at 13·62 feet per second, and the quantity 77½ gallons per minute—which shows that, in this experiment, the actual discharge was $\frac{58\cdot25}{77\cdot50}$, or very nearly about three-quarters of the amount per theory.



By referring to what is stated above, we shall have the quantities actually discharged for the several elevations of water as numerators of fractions, of which the quantities per theory will be denominators—viz.:

For height of water ... feet 198 = $\frac{153}{390}$ = 0·392
Ditto ditto ... ,, 196 = $\frac{386}{664}$ = 0·581
Ditto ditto ... ,, 130 = $\frac{287}{562}$ = 0·510
Ditto ditto ... ,, 70 = $\frac{180}{413}$ = 0·436
Ditto ditto ... ,, 37 = $\frac{128}{300}$ = 0·427
Ditto ditto ... ,, 20 = $\frac{96}{220}$ = 0·436
Ditto ditto ... ,, 3 = $\frac{64}{85}$ = 0·753
Ditto ditto ... ,, 1 = $\frac{37}{49}$ = 0·755
Venturi's experiment—2·8844 = $\frac{58\cdot25}{77\cdot50}$ = 0·754
} Reduced to decimals for comparing the relative values.

The closeness of the results of Venturi's experiment, as compared with the two least discharges of water from the mine, will be strikingly apparent, but all the rest of the results are much less in proportion to the theoretic quantities, and there appears to be a regularly graduated diminution on to the charge of 37 feet, and from that to the greatest depth of 198 feet, the results appear to be regularly increasing. Hence arises a question—What is it that occasions this inequality in the results, and presents, in the discharges, a sort of regularly decreasing quantity, as compared with theory, on to a certain elevation of the water, and then again regularly increasing? Before this question can be properly investigated, it would be needful to get the results of more experiments, and it would be desirable, where parties have an opportunity of doing so, to carefully ascertain the height of the charge of water with the quantity discharged in a given time, and the dimensions of the orifice of discharge.

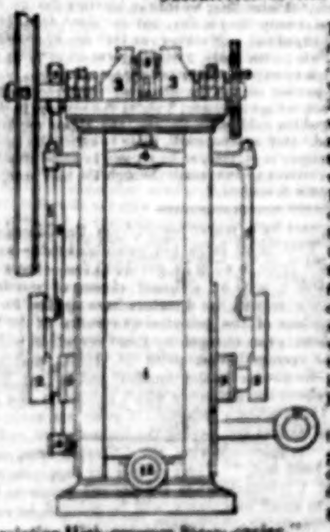
ROLLS' DOUBLE REVOLUTION HIGH PRESSURE ENGINE.

(We are indebted for the annexed engraving to our contemporary, the *Mechanics' Magazine*, in whose pages the communication originally appeared.)

Sir,—I beg to send you a sketch of an engine of my invention, which I consider to be perfectly new, and to possess some obvious advantages over those in ordinary use. Should you favour it with a place in your valuable Magazine, you will much oblige, Your obedient servant,

Albany road, Old Kent-road, London. T. Rolls.

DESCRIPTION OF THE FIGURES.



In fig. 3, which is a side view, 1 is the cylinder; 2 2, cranks on shaft through the cylinder; 3 3, main crank; 4, cross head, with connecting-rods to cranks 2 2; 5, strap head, connected with cross head 4; 6 6, the connecting-rods of 4 and 3 3; 7, the eccentric, worked by cog-wheels, 10, in the proportion of 12 to 24, the smaller one being on the main shaft, the larger on the eccentric spindle, so that the shaft makes two revolutions for the eccentric's one; 8, rod from the eccentric, to work the cylindrical slide-valve, 14; 9 9 9, stuffing-boxes; 10, the two cog-wheels, in the proportion of 12 to 24; 11, steam-pipe from boiler; 12, waste-pipe; 14, cylindrical slide-valve.

As the crank traverses one-third the circuit, the steam crank performs one revolution; and, on account of this, which is the distinguishing feature of the engine, I call it the "Double Revolution High-pressure Steam-engine."

On Acids of Sulphur.—Specimens of a new ox-acid of sulphur were submitted to the Paris Academy of Sciences; this acid, having for its formula $S^4 O^5$, has been named by the discoverers, MM. Fordos and Gelis, bisulphuretted hyposulphuric acid. It completes, according to them, a curious series of the ox-acids of sulphur, the quantity of oxygen remaining constant, whilst that of sulphur increases according to the numbers 2, 3, 4, thus:—Hyposulphuric acid, $O^5 S^2$; sulphuretted hyposulphuric acid, $O^5 S^3$; bisulphuretted hyposulphuric acid, $O^5 S^4$. MM. Fordos and Gelis have succeeded in isolating their new acid, and also some of its principal compounds. The following are some of its properties:—It is but slightly more changeable than the hyposulphuric acid. It is colourless and transparent; and, if it be boiled, it is decomposed into sulphur and sulphuric acid. Free or combined, it is not altered by the sulphurous and sulphuric acids—nitric acid, on the contrary, throws down sulphur.

MUSEUM OF ECONOMIC GEOLOGY OF INDIA.—

The objects of the Museum of Economic Geology of India, which has been established by Government at Calcutta, under orders from the Honourable the Court of Directors, in combination with the Asiatic Society, and at its rooms, are the following:—They are, as scientific men will perceive, generally those of economic geologists in all countries, but there are some peculiarities connected with India, and the situation of Europeans in it, which will oblige us to go into a little detail, to explain to those who may not already take an interest in these matters, our views, our wishes, and our hopes of the advantages which may accrue to the community from this new establishment. Its objects, then, are briefly these:—

1. To obtain the most complete Geological, Mineralogical, and Statistical knowledge possible of all the mineral resources of India, wrought or unwrought, so as to make them as publicly known as possible; to show how they have been, or are now wrought, or how they might be so to the best advantage.

2. To obtain a complete set of specimens, models, and drawings relative to the Mining Operations, Metallurgical Processes, and Mineral Manufactures of all kinds, of India and of Europe and America, so as to afford to the public information of every thing which can be turned to account here or in Europe, and, perhaps, prevent loss of time, waste of capital, and disappointment to the Indian speculator.

3. To furnish the engineer and architect with a complete collection of all the Materials, natural or artificial, which are now, or have formerly been used for buildings, cements, roads, &c., and of all which may possibly be useful in this department, whether European or Indian.

4. To collect for the agriculturalist specimens of all kinds of Soils remarkable for their good or bad qualities, with the subsoil, subjacent rocks, &c., and, by examination of them, to indicate their various peculiarities and the remedies for their defects.

5. To collect for medical men the waters of Mineral Springs, Mineral Drugs, &c.

6. And, finally, by chemical examinations of all these various specimens, to determine their value, and how they may be best turned to account for the general benefit of the community.

With objects like these, the Museum of Economic Geology may be said to be placed between the purely scientific geologist and the merchant, the miner, the farmer, the manufacturer, and the builder; or, in other words, the merely practical man, who may desire to know how the knowledge of the geologist and mineralogist—to them often so recondite, and apparently so useless—can forward their views; and its office to be, if possible, to answer all questions of this nature which may arise, for public benefit.

This may sometimes be done from books, but the great library must be the collections of our Museum, which are, in fact, a library of examples, to which the commentary is the laboratory, where, aided by the resources of the collection, questions may often be solved in an hour, a day, or a week, which it would take half an Indian life to obtain the mere materials for investigating. An extensive collection, then, is the first requisite, and this should, if possible, comprise every inorganic product of the earth from which mankind derive any advantage, with every information relative to it. It will readily occur to the reader, that, in India, owing to her infancy in some of the arts dependent on these products, as in mining, agriculture, &c., and her singular progress in others, as in peculiar branches of metallurgy, and the like, our almost absolute ignorance of what her methods and resources are, the peculiarities of situation in which these resources may exist—those of climate, seasons, and many others—we have almost every thing yet to learn; and that, to accomplish our objects, we cannot be too well furnished with all the knowledge and examples of Europe and the Americas, and all those of India, or of Asia. Without these our progress must be very limited; but, in proportion as we obtain them, we may hope, without presumption, to see the day when the mines, the quarries, and the soil of India may be done justice to, which, assuredly, has never yet been the case.* In this all classes are so clearly interested, that it would be superfluous to show it, as it is to show that the resources of every country are far more readily developed with public means for investigating, preserving, and publishing all knowledge belonging to them, than where none such exist. It is, therefore, hoped, that those who may be desirous of assisting this great public work will bear in mind, that nothing, however familiar it may be to them on the spot, is indifferent to us; for, if not wanted for the institution, it may serve to procure that which is; and the following note is given rather as a general memorandum than as specifying all which is desired. The general rule is, that details cannot be too minute, nor specimens too various, particularly if purely Indian.

DESIDERATA FOR THE MUSEUM OF ECONOMIC GEOLOGY OF INDIA.

I.—MINES AND MINING PRODUCTS.

1. Specimens of all crude ores, just as found; if possible, also, of the rocks or matrix in which found—of those indicating the vein at the surface—of the walls of the veins—of the strata or beds passed through before reaching them—and of the rocks of the surrounding country.

2. The ores, after preparation for the furnace, by picking, washing, stamping, roasting, &c.

3. The rejected ores, gravel or stones found with those used—which often go under odd names, as those of "mother," "devil," or the like.

4. The fluxes used, if any.

5. Memorandum of the kind of fuel used—samples of it, if coal or coke, &c.; names of the trees, as bamboo, &c., if charcoal—and, if not too far, send specimens.

6. The roasted, or half smelted, ore.

7. The pure metals, as obtained in a merchantable state, of all the qualities.

8. The slags, of all kinds, from the furnaces and smeltings.

9. Drawings or models (to scale, if possible) of all furnaces, machinery, and implements used in any of the processes, with drawings, plans, and sections of the mine.—Serviceable models of the furnaces, &c., may often be well made by the native image makers for a mere trifle.

10. Specimens of any tools used.

11. Traditions, history, and statistics of the mine or mineral products, as—1. How and when discovered—2. Produce, gross and net—3. Rent, if farmed, or what tax payable on the product—4. Price of daily labour—5. Amount of labour obtained for a given price—6. Estimated profits, past and present—7. Reasons for decay or increase—8. What is now required to make the mine more productive—9. Copies or notices of any books or accounts of the mine—10. Health, comfort, morals, and condition of the workmen employed, average of ages, and of life among them, if thought unhealthy; seasons and hours of work; superstitious notions, peculiar diseases, &c.

II.—BUILDINGS, CEMENTS, POTTERY, COLOURS, ROADS, &c.

1. Specimens from the quarries, of all kinds of building stones, useful or merely ornamental.

2. The same of limestones, shells, corals, or other articles, used to make lime or cements, of all kinds.

3. Specimens of the strata above and below the quarried stone.

4. Any fossil shells, bones, fish, plants, insects, or other appearances of organic remains, large or small, found in or near the quarries, or amongst the [illegible] and watercourses of quarried spots. If specimens appear too large to move, please to give a notice, with an eye-sketch, and estimate of the expense of moving, and preserve it till a reply is sent.

5. Specimens of the building stones or remarkable bricks used in any public edifices, monuments, or tombs, with the date of their erection, if known, and a note to say if exposed to weather or protected by chunam, paint, or tiles.

6. Memoranda and specimens of any plants or animals destructive to masonry, as boring worms and shells in water, and the like, with specimens of their work.

7. Ornamental or stucco work—specimens of it, new or old, interior or exterior, with the best account procurable of the materials, preparations, and working of them.

8. Specimens of clays and marbles, shells, &c., used for image or ornamental making—of earths for pottery, and varieties of coloured earths of all sorts, whether used as pigments or not.

9. Specimens of peculiarly good materials used for roads, whether ancient or modern, with prices, methods of using them, and other memoranda.

10. Prices of all the above—rates of labour, carriage, &c., from the rough to the wrought state, and all other statistical details, as in the case of mines and mineral products above mentioned.

III.—AGRICULTURAL GEOLOGY.

1. Specimens of soils of good, and the best qualities, for all kinds of produce, as sugar, cotton, tobacco, &c.

2. Of inferior soils or mines of earth.

3. Of the subsoil or rock.

4. Of the stones scattered about these soils.

5. Memoranda relative to the height of these soils above the water of wells in the rains and dry season, and of its drainage, shelter, exposition, &c.

6. Of any kind of earths, sand, or stones used as manures, as grain from the jheels, kunkur, &c.

7. Of the deposits (fertile and infertile) left either by the autumnal inundations or by violent floods, with memoranda of their effects on the cultivated soil.

8. Specimens from any separate spots, where gravel or stones are collected in quantities after inundations or floods.

9. Accounts of remarkable floods, and average heights of the rise of rivers, of the raising of the soil, alterations in its produce consequent thereupon, and all other details.

10. Memoranda relative to the formation or destruction of river banks, islands, &c., with measurements, if attainable.

11. Samples of all kinds of efflorescent salt earths, with specimens of the different salts prepared from them, prices of preparation, selling rates, and accounts of the processes and uses of the salts.

12. Specimens of brine springs, with details of manufactory, if boiled for salt, and statistics of labour and produce, &c., as in the case of mines.

IV.—MEDICAL GEOLOGY.

1. Specimens of mineral substances of all sorts, whether procured on the spot or imported, crude and prepared, with notes and samples of the process of preparation in all its stages.

2. Of the waters of mineral springs, their temperature, local traditions about them, account of their uses, and specimens of the rocks or soil in which found.

V.—NATIVE METALLURGICAL PROCESSES, or MINERAL MANUFACTURES.

1. Exact descriptions of them, however rude or simple they may appear, with samples of the ores, fuel, fluxes, products, slags, &c.

2. Models or drawings (to scale, if possible) of the furnaces and implements of all kinds; specimens of these last may be sent.

3. Memoranda and samples of the earths or sands used for moulds in castings, of the crucibles and bricks, raw and baked, and of the raw material from which made.

4. Prices of raw and wrought materials.

5. Drawings of machinery used for turning, boring, polishing, &c.

In conclusion, it is not to be expected that any individual, unless totally devoted to the search, can supply the whole of the desired specimens, or even of the foregoing subjects, in any one district; but any single item of the foregoing may be of importance, at some time, in some place; and it will be the especial duty of the Asiatic Society, and of the Curator of the Museum, to see justice done to every contribution, whether relating to the Geology of India in general, or to this particular branch of it.

H. PIDDINGTON,
Curator, Museum Economic Geology.

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* It is curious to find that, upwards of 150 years ago, the ores of the precious metals were an article of export from the British East Indies. This is clearly shown by the following passage from [illegible] work, as translated by [illegible], and published by him under the title of [illegible], 1711. In vol. ii., p. [illegible], [illegible] "the East Indian ores and their [illegible] by the [illegible]," he [illegible] by [illegible] a private channel, twenty-five quintals of ore from the East Indies," &c. And again—"These sorts of ores [illegible] were sent from India by the Dutch, were frequently [illegible] at the foundry of [illegible], in the Upper Hartz, but had never been assayed in the [illegible]. This ore was in lumps, from the size of a nut to that of a walnut, and, by trials, it was found [illegible] the quintal of 110 lbs. contained 1 oz. 4 dwt. of gold, and 3¼ oz. of silver."

11

SPECIFICATIONS OF RECENT PATENTS.

William Fairbairn, Esq., Millwall, Poplar, *for improvements in the construction of steam-engines, whereby such engines are rendered more compact and more applicable to marine as well as other purposes.*—Four upright columns support the upper part of the frame-work, and are firmly secured to the foundation plate of the engine, the parallel motion of the piston-rod is made to work the piston and *force* pumps, and is obtained by vibrating levers mounted in bearings, one end of which is connected to the cross-head which works the pistons and force-pumps, and the other to such point as may be necessary to make a true parallel motion; attached to these are a pair of pendant rocking levers, one of which is attached to the cross-head, and the other to the connecting-rod, by this means all the necessary motions of the different parts of an engine are obtained, and applied in a much smaller compass than that usually required. The patentee claims, first, the arrangement and disposition of the various parts of a steam-engine, or any slight variation thereof, and, secondly, the arrangement and construction of the vibrating levers, and other parts necessary for obtaining the parallel motion, and by which, at the same time, the air-pumps and force-pumps are worked.

James Ions, gentleman, Newcastle-upon-Tyne, *for improvements in smelting copper ores.*—For the purpose of effecting this improved process, the hearth or bottom of the cupola is built of brick or stone in the usual way, but round its exterior surface, plates of iron or other metal are fixed in segments or squares as may be desired; this metallic casing is made in such a manner that any part may be removed without displacing the whole, as it may be required to gain access to the interior of the furnace; an opening is made at the bottom of the furnace, and another two feet above for the egress of the regulus and scoria, the interior of the cupola is composed of brick or stone, but the outside is surrounded by pipes or compartments of iron to admit a copious circulation of water about the masonry to keep the outside of the cupola at a low temperature, to obviate the necessity of frequent repairs; at the head of the cupola is an opening for the admission of the ore, and opposite is the vent or flue for carrying off the vapours, this flue is connected with a tower or chamber in which the products of the vapours are deposited either in a state of sublimation or as vapour, to facilitate the deposition of the vaporised substances, a quantity of material, such as flags, slates, nodules of stone, or other convenient substances are placed in the chamber in such manner that they present as large an extent of surface to the vapour as possible, without offering any serious obstruction to the draught, and a sufficient quantity of water must be constantly supplied to the interior of this chamber to keep it cool, and to wash down the deposited substances into a receiver at the bottom. The operation of smelting is as follows:—The ore having been roasted is put into the cupola with a proper proportion of lime, silex, or other flux; the mass being melted, is allowed to accumulate till it rises nearly to the tuyere holes, when the slag tap is opened, and the scoria escapes in fusion from the surface of the melted copper, which falls to the bottom as a regulus, and may be run off into pigs in the usual manner. In the course of these operations, generally in about eight days, a portion of the iron contained in the ore partly in combination with copper, will be found incrusted on the bottom and sides of the cupola, and must be removed, which is done by taking away some portion of the beforementioned metal plates to gain access to the furnace, without being obliged to pull down and reconstruct the whole, the metaliferous substance thus removed is then treated with acids to remove the iron, from which is made muriate or sulphate of iron, and the remainder treated as a regulus of copper.

The patentee claims—1. The construction of a cupola, or furnace, having metal plates outside the hearth, with holes for tapping off the regulus and scoria. 2. The use of a *refrigerator* round the furnace, to keep the masonry at a low temperature. 3. The erection of a chamber or tower, containing substances so placed as to offer a large surface for the condensation of the vaporised substances, and for washing down, to a vessel below, the deposit therefrom. 4. The smelting of copper in a cupola, and the separating, at one operation, the copper regulus from the ferruginous and earthy constituents of the ore. 5. The treatment of the subsidiary substance before mentioned.

S. W. Smith, iron-founder, Leamington Priors, Warwickshire, *for improvements in regulating the heat of furnaces for smelting iron, which may also be applied to retorts for generating gas.*—This improvement is effected by bringing into action the force of the air, as it passes to the blast furnace, or by the temperature of the air when hot-blast is used. The air is forced from the blowing machine into an air chest, from whence it is conducted through a pipe to the furnace. In this pipe is a valve, mounted on an axis, by the opening or closing of which, as the pressure of the air increases or diminishes a regular blast is obtained. To regulate the working of this valve, there is a small cylinder and piston fastened to one side of the pipe, with which it communicates, by means of a beam and connecting rod, when, by the quick travelling of the piston of the blowing machine, the pressure of the air in the pipe is increased, the valve will be closed in proportion, and when, by the lessening of the speed of the blowing apparatus, the pressure is decreased, the valve will open wider. Thus, a more equal blast, and, consequently, a more regular temperature, will be obtained. When the blast is to be regulated by the temperature of the air, a valve is placed in the chimney or flue of the heating apparatus, and regulated by the apparatus to close or open the draft, as the air, in a pipe from the heated air chamber, becomes of higher or lower temperature. The patentee claims—1. The regulating the heat of furnaces, by taking advantage of the pressure and heat of the blast, as herein described. 2. Regulating the heat from gas retorts, by causing the temperature to act on suitable apparatus, connected with a damper in the flue or chimney.

R. Bradley, W. Barrows, and J. Hall, iron-masters, Tipton, Staffordshire, *for an improved method of making iron.* This invention consists in a mode of preparing the tap cinder, and applying it, when so prepared, to the manufacture of iron. The cinder is obtained from the puddling furnace, when converting crude into malleable iron, and, by a continued process of roasting, it is rendered available for protecting the sides and bottoms of the furnaces, in which the puddling of the refined iron, and the boiling or puddling of crude iron, is performed. The patentee claims the mode of making iron, by preparing and applying the tap cinder as before mentioned.

Charles Schafhaeutl, gentleman, Cornhill, *for an improved method of smelting copper.* This improvement consists—1. In reducing the ore to a pulverised state, and then mixing it with quick lime, and forming it into thin mortar, to which common salt is to be added, the proportions being according to the richness of the ores used. When it contains from 8 to 12 per cent. of copper, two-and-a-half parts lime, one part salt, to five parts ore. This mixture is then calcined in the common calciner, or in the improved calciner, which forms the second part of this invention, and which is intended to create a more perfect and rapid contact of the air with the ore on the hearth, and to prevent any sulphureous or arsenious fumes escaping into the atmosphere. In this improved calciner, every part is made perfectly air-tight; the hearth is open to the access of air on one side only. The air, therefore, that feeds the fire, rushes here in one continued stream over the ore on the hearth, oxidising the sulphur and arsenic, and carrying with it all the fumes into the air chamber. From this chamber, it passes along with the steam that arises from the water (which runs slowly along the ash pit), through the ignited fuel in the fire-place, and the fumes are thereby converted into sulphuric acid, and streams backwards with the flames into the flame chambers, where it may be condensed by means of steam. When the mixture is thoroughly calcined, it is raked through the water, afterwards thoroughly washed, and is ready for smelting.

John Player, jun., engineer, Loughor, near Swansea, *for improvements in furnaces and fire-places for consuming anthracite and other fuel, for generating steam, and smelting iron and other metals.*—For steam-boilers the apparatus consists in the application of a feeding chamber, which is filled with anthracite, and passes through the boiler into the furnace; the anthracite thus falling gradually into the fire, is brought to a highly heated state before reaching the furnace, and being thus heated, burns to greater advantage, and without decrepitation, which takes place when thrown on the fire in a cold state. The second improvement consists in a mode of constructing smiths' hearths, so that anthracite may be burnt therein; this is also accomplished by a feeding chamber, from which the coal descends at a high temperature, before coming within the influence of the blast. The third improvement consists in a mode of constructing cupola furnaces for smelting iron ores, and remelting iron by anthracite. The upper part of this improved furnace is formed into a chamber, and in this particular alone it differs from the ordinary furnace; this chamber acts as a calciner, being surrounded by flues leading to the chimney; the charges of anthracite iron ore and flux are put in proper proportions in at the top of the calcining chamber, and thus become gradually heated before reaching the body of the furnace. The fourth improvement is for a new construction of a refinery-furnace, so formed as progressively to heat the fuel before reaching the fire. And the patentee claims these different improved modes for constructing the four descriptions of furnaces herein before mentioned.

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AMERICAN PATENTS.

[From the *Journal of the Franklin Institute.*]

Perry Davis, Fall River, Bristol county, Massachusetts, *for an improvement in the process of hardening steel, August 4.*—The method of hardening steel, as practised by the patentee, is as follows:—"Instead of plunging the steel to be hardened into cold water, as is usual, it is plunged into a composition of borax, oil, and charcoal, to harden it, which mode of hardening renders the metal malleable with the same degree of hardness that was obtained by the old method; so that the metal, after being hardened in this way can be straightened or bent without any danger of being broken." Claim—"What I claim as my invention, and which I desire to secure by letters patent, is the mode of hardening steel so as to render it flexible by means of the composition of oil, charcoal, and borax, as set forth." What influence the above-described mixture can exert upon the part to be hardened, we are at a loss to perceive, and apprehend that the method frequently practised of using oil alone, would have the same effect with the compound above indicated. We have been in the habit of hardening steel, and know of many devices which have been resorted to for the purpose of communicating toughness, but believe them all to be founded in error. The less rapid the cooling, the less will be the hardness, and of course, the greater the toughness of the article operated upon.

Horatio Allen, New York city, *for improvements in the cut-off valves of steam-engines, August 21.*—The object of this patent will be understood by the following claims:—"What I claim in a patent for an adjustable cut-off is as follows:—1. I claim the combination of two independent cut-off slides, adjustable on the same rod, to be used instead of the single cut-off slide as employed in the combination patented by Isaac Adams, May, 1838, the two acting on top of the slide valve with apertures, as described in said patent, but I do claim the slide valve with apertures; and, consequently, this part of my adjustable cut-off, is for an improvement on Adams's cut off, whereby his cut-off is made an adjustable cut-off. 2. I claim the arrangement herein denominated cut-off, with fixed seats and adjustable slides wherein two independent cut-off slides are combined with two fixed seats, one for each end of the cylinder, and each containing an opening for the passage of steam to its respective end; said slides being adjustable on the rod carrying them, and driven by an eccentric, or cam, on the engine-shaft, or by the reciprocating motion of the cross-head suitably reduced, all as described. 3. I claim the manner in which the two cut-off slides are made simultaneously adjustable by means of right and left hand screws on the rod carrying them, as described. 4. I claim the arrangement and combination for turning the rod carrying the slides, by means of a nut, or cog-wheel, through the axis of which the rod passes, and is free to have a reciprocating motion lengthwise, but with which the rod must turn when the nut, or wheel, is turned, as described. 5. I claim the arrangement herein denominated 'cut-off with adjustable seats,' wherein a cut-off slide, or two cut-off slides, on the same rod are combined with two adjustable seats, one for each end of the cylinder, and each containing an opening for the passage of steam to its respective end. The cut-off slide, or slides, being permanently attached to the rod carrying them, and driven by a cam, or eccentric, on the engine-shaft, or by the reciprocating motion of the cross head of the piston, suitably reduced for the required movement of the slides, and the seats being simultaneously adjusted by levers from a common shaft, or by a pinion acting on a rack from each seat, or by the action of right and left-handed screws or a rod passing through and carrying both seats, as described."

Ethan Campbell, city of New York, *for a self-acting feeder for supplying steam-boilers, August 28.*—In this feeder the supply of water to the boiler is regulated by two floats, one in the boiler and the other in a feeding cylinder, or reservoir. The upper part of the boiler communicates with the upper part of the feeding cylinder by a pipe governed by a valve, connected with the rod of the float in the feeding cylinder, for the purpose of admitting the steam to press on the top of the water therein. The stem of this float is also in connection with another valve which regulates the admission of water to the feeding cylinder, which is connected with the boiler below the water line, by means of a pipe provided with two lifting, conical valves, one of which is operated by a lever that is attached to the stem of the float in the boiler. When the reservoir has a sufficient supply of water, the float is borne up in it, which keeps the valve in the supply pipe closed, and that in the steam pipe open, thus admitting and equalising the pressure of the steam on the water in the two vessels. In this condition the apparatus is in readiness to supply water to the boiler when it becomes necessary. When the water in the boiler sinks too low, the float following it, the valve in connection with this float is opened, and, as the other valve in the same pipe opens upwards, the head of water in the reservoir being higher than in the boiler, and the steam pressing equally on both, this valve is opened, and the water flows into the boiler until it reaches the level of the water in the reservoir which closes the valves, and stops the supply; and the discharge of the water from the reservoir causes the float therein to sink, and to close the valve in the steam-pipe, and open the one in the supplying pipe. The claim is to the mode of combining the operation of the float in the reservoir, and the valves in the steam and supplying pipes, with the float in the boiler, and the valves in the pipe which conducts the water to the boiler.

Joseph Echols, Columbus, Muscogee county, Georgia, *for improvements in the condenser and apparatus for supplying steam-boilers, August 11.*—The apparatus, as described, for supplying boilers, consists of a receptacle, communicating with a cistern and with the boiler, by means of pipes governed by a *four-way cock*, which alternately forms a connection with the cistern, from which to receive the water, and then with the boiler to supply it with the water thus received. The pipes forming these connections are narrow and high, and the one leading to the boiler has an inclination towards, and opens into it, above the water line. Thus, when the communication between the boiler and receptacle is open, the steam from the *former* passes into the latter, and from this the water runs down the lower inclined surface of the tube into the *former*. The cock being then turned, cuts off this communication, and opens it with the reservoir, which allows the water to run into the receptacle, and condense the steam, by which the water was expelled in the previous part of the operation. For low-pressure engines, it is said that the top of the reservoir must be closed, and a connection formed between it and the condenser. The condenser is divided into two compartments, separated by a diaphragm pierced with small holes, and this forms a connection with a cistern of cold water, by means of a four-way cock and receptacle, such as are employed in the apparatus for supplying water, and operates in the same manner. The condenser is also connected with the cylinder of the engine, and is provided with an aperture and valve for the discharge of air and water. The water, after passing from the cistern into the receptacle, escapes into the upper division of the condenser, and percolating through the perforations in the diaphragm, condenses the steam. The air is forced from the condenser into the receptacle by the entering water, and in the same manner from the receptacle into the cistern.

Claim—"What I claim, and desire to secure by letters patent is, first, the manner in which I have combined and arranged the said cistern, receptacle, the said four-way cock, and the boiler, with said respective water passages, so as to effect the object of dispensing with force-pumps (now in use for supplying boilers) and of giving a regular supply of water to the boiler, and of maintaining it at the same and desired height at all times, as above set forth. I do not claim the use of a four-way cock (except so far as using the plug of the same with only one passage through it) or of any of the respective parts of this apparatus taken individually; but I do claim them collectively in the particular combination described, not intending, by this claim, to limit myself to the exact form and manner of constructing the respective parts aforesaid, but to vary them as I may find expedient while they remain substantially the same, as herein before set forth. Secondly, I claim the manner in which I have combined and arranged the foregoing described apparatus for condensing steam and for discharging a portion of the air liberated therefrom without the employment of an air-pump—that is to say, I claim the manner in which I have combined and arranged the cold water cistern, the steam receiver or condenser, the receptacle and the four-way cock, so as to effect the condensation of steam and of discharging a portion, at least, and in some situations nearly all, the air from said receiver or condenser through the said receptacle and cock substantially as herein described."

Prices of Gas.—It appears by a recent report from the Manchester board of gas directors:—"That in all large gas establishments—except those in Liverpool, where the price to all is 7s. per 1000 feet—the charge varies according to the quantity used by different classes of consumers. With reference to their present report, the directors have applied for and obtained returns from seventeen of the principal gas works of the kingdom, and the average highest price charged by those seventeen works is 8s. 6½d. per 1000 feet; the average lowest price 5s. 10¾d., making an average difference between the charge to the smallest and largest consumers of 2s. 1½d. This is about the difference which existed in the Manchester scale till the year 1836, when a reduction of price was made of 1s. per 1000 feet to the class of consumers, paying the highest price, and none to the class paying the lowest price—leaving the difference here, as it at present stands, at 1s. per 1000 feet." The new rate for supplying gas in Manchester commences at Christmas, when the present prices of 6s. to large consumers, and 7s. to small consumers, will be reduced to 5s. and 6s. per 1000 cubic feet, according to the quantity consumed.

Important to Gas Consumers.—A case involving a question of much importance to the public came before Mr. Hardwick, at the Marlborough-street Police Court, a few days since. The Commissioners of Pavements for St. James's charged the directors of the Equitable Gas Company with an infringement of Michael Angelo Taylor's Act, in having broken up the pavement for the purpose of laying down a service pipe without their consent. After considerable argument, Mr. Baker, for the gas company, said that the Act only referred to main pipes, and Mr. Smith, for the commissioners, that it meant *all description of pipes*.—Mr. Hardwick said he felt satisfied the wording of the Act had been carefully attended to, and that the Legislature intended it to prevent the breaking up the pavement under any circumstances, without giving previous notice; but Mr. Baker having stated that a decision on such opinion would be productive of the most important results, and requesting a postponement, Mr. Hardwick agreed to adjourn the case.

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Museum of Economic Geology.—Few of our readers, probably, are aware that amidst the numerous and attractive public exhibitions of the metropolis, there is one which pre-eminently merits the attention of every one concerned in practical mining, as well as of all persons interested in the management of property, or in the application of geological science to the arts. The Museum of Economic Geology, established by Government, in Craig's-court, Charing-cross, has for its object the collection of every material that is derived from mines and quarries, &c., for the purposes of commerce and the arts, and also for the collection of exact models of machinery employed in the various processes. Hence the miner or manufacturer can, at leisure, observe the different methods employed in different districts, &c. &c. This design, liberally supported by Government, owes much of its utility to the indefatigable zeal of Sir Henry De la Beche, &c., of Mr. T. B. Jordan, the resident curator, and of Mr. Phillips. We shall, probably, in some early Number, commence a popular description of the several departments of the museum, which are especially deserving public attention.

Scientific Inventions.—In viewing the various implements which the art of man has brought into operation, to supply him with the necessities and comforts of life, it is interesting to trace the nationality of each. As regards the Dutch, the physical geography of Holland necessarily led the inhabitants to cultivate the art of raising water, thus it was a Dutchman who constructed the famous works at Marlé, and England is indebted to another for the old works at London-bridge; the simplest pump-box known is of German origin, as also the tube pump of Muschenbroek, hose for fire-engines, both of leather and canvas were invented by the Dutch, and they carried the chain pump to China and India, and first introduced it into Europe. Windmills for draining water first occur (in modern days) in Holland, and it is, indeed, the constant employment of this element (wind), which preserves them from destruction by another (water). The French have followed the German and Dutch in hydraulic machines, and we have the double pump of la Hire, the frictionless piston of Gosset, Papin was one of the inventors of the steam-engine, le Demour invented the centrifugal pump, and drawn leaden pipes were projected by Delesme. In England, connected with the steam-engine, we have the names of Cartwright, Barton, Worcester, Savery, Newcomen, and Watt; and to the Italians we are indebted for the inventions and improvements of Galileo, Torricelli, Porta, and Venturia.

To separate Silver or Gold from Lead.—Take a few grains of bone ash, make it into a paste with a little saliva, spread it about one line thick on a piece of charcoal, and make a shallow impression in it, to receive the globule of metal. Expose it to the heat of the blowpipe, so as to burn it white and hard, and then melt the globule of the alloy on it, and keep it in a constant red heat, till the lead is all oxidised. The advantages of the bone ash over the mica sometimes employed are manifold. 1. It is easier to be obtained, and everywhere the operator can prepare a little if he should not be supplied with it. 2. The metal will remain in the concavity of the bone ash paste, and not be liable to run down and be lost, as on the mica. 3. It is never necessary to change the material; the bone ash absorbs the litharge which collects on the mica, and impedes the process, so that the remaining metallic globule has to be transferred to a fresh slip of mica. 4. The colour of the paste, after the operation is finished, gives an indication as to the nature of some impurities of the metal; lead alone makes it appear yellow; a small proportion of copper changes the yellow colour to greenish.—*Dr. G. Engelmann.*

Manufacture of Sulphuric Acid from Gypsum.—Thaulow has proposed the following method for preparing sulphuric acid in large quantities from gypsum. The gypsum is reduced in iron or earthern retorts by heating with charcoal; the carbonic acid which is evolved is not suffered to be lost, but is preserved for further use. The sulphuret of lime is mixed with some water, and the carbonic acid gas passed into it; the sulphuretted hydrogen which evolves is conducted into leaden chambers, and there first burnt to water and sulphurous acid, and this latter oxidised in the usual way.—*Archiv. der Pharm.*

Test for the Adulteration of Æthereal Oils with Alcohol.—The best method of testing, according to Borsarelli, is with chloride of calcium. Perfectly dry chloride of calcium dissolves in oils containing alcohol, and forms a liquid stratum at the bottom of the vessel; when but little alcohol has been mixed with them, the pieces change, at least their form, but in pure oils the chloride of calcium remains perfectly unaltered. This has been confirmed by Brandes on oil of lemons.—*Archiv. de Pharm.*

Polarization of Light.—M. Arago has made an interesting communication to the Paris Academy of Sciences, on the theory of light. The discovery of the phenomenon of the polarisation of light has been a stumbling-block to the partisans of luminous undulations. Dr. Young saw no other way of getting out of the difficulty than by modifying the hypothesis, by supposing that luminous vibrations take place in a direction perpendicular to the axis of the ray. This conception offered a new resource to the partisans of the theory of undulation; but it was so new and extraordinary that it could only be regarded as the suggestion of despair, and Dr. Young was himself so little satisfied with it, that he communicated it only to M. Arago, concealing it from the public. MM. Fresnel and Arago, however, followed up the suggestion, and victoriously established Dr. Young's hypothesis. M. Arago now states, that in going through the papers of the Royal Academy of London, he has discovered that long before Fresnel or Young, and when no experiment was known which could seem to warrant the idea, an English philosopher (Mr. Hook) laid down the hypothesis of luminous undulations precisely in the manner it has been realised by recent experiments.

Weight and Heat of Air.—The remarkable difference in the density of the air at different heights is particularly worthy of our attention; for the capacity in the atmosphere for receiving and containing heat from the sun's rays depends on this peculiarity in its condition. It is well known that the air is much more warm on low than on high grounds; but it is perhaps not so generally understood, that this arises from the difference of density in the air at the two places. If we take a pound-weight of air near the sea's level, and another pound-weight at a spot a mile above the sea, we shall find that each pound contains precisely the same quantity of heat; but in the case of that taken near the sea the air will feel warm, and in the case of the other the air will feel cool. This seems a contradiction, yet it is a truth. A pound-weight of air taken near the sea is compact in substance, and goes into a comparatively small bulk; but that taken from a high part of the atmosphere is thin, and occupies a much larger space. This explains why the thin air on high grounds is seemingly colder than in low situations. Aloft the air is as warm as it is below, but there is less of it—the particles are more widely asunder; and this produces the effect of a greater coldness. Properly speaking, the cold in high situations arises from the want of air, rather than from the air itself.—*Jackson's Agriculture.*

Galvanic Experiment.—Mr. Robert Hunt (secretary of the Royal Cornwall Polytechnic Society) gave a brief notice, at the meeting of the Royal Institution of Cornwall, of an experiment which appeared to prove that an exceedingly weak electric current was capable of effecting the decomposition of the yellow copper pyrites. He had on the evening previous, placed in a tall cylindrical vessel, a saturated solution of sulphate of copper, above which he carefully floated a solution of potash—the two fluids being kept from uniting only by the difference of their specific gravities. A piece of copper pyrites, suspended by a piece of silk, was so placed that one half was in the sulphate of copper solution, and the other in the solution of potash. The result was, that in a very few hours that part of the ore which was in the copper solution was converted over its surface into grey ore; the other portion remained unchanged. Several crystals of native copper were also formed, and against the sides of the glass a ring of the peroxide of iron was formed, the iron being derived from the yellow ore, a double sulphuret of copper and iron. Mr. Hunt exhibited the piece of ore to the meeting.

A "Magician" on the Thames.—A new iron steamer has lately been launched on the Thames, and christened the *Magician*, and if all that is said of her be true, she certainly deserves the name. She is 300 tons, 110-horse power, her lines are beautiful, and her paddles Morgan's feathering plan. It has been stated that she goes at the rate of fifteen miles per hour, and that, on one occasion, she started from Woolwich one hour after a Government steamer, of 320-horse power, and within one hour overtook and passed her.

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